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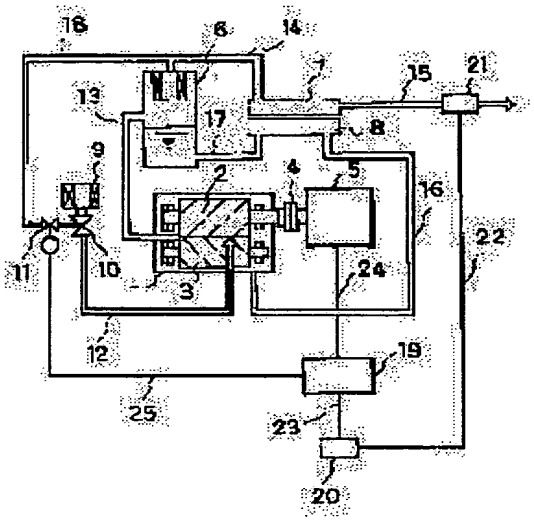
(54) CAPACITY CONTROLLER FOR INVERTER-DRIVEN SCREEN COMPRESSOR

(57)Abstract:
PURPOSE: To provide the compressed air always having a constant pressure independently of the variation of the used air quantity by detecting the pressure of the compressed air discharged from a screw compressor and calculating the output revolution speed of an inverter so that the variation for the set value of the detection value becomes min.
CONSTITUTION: A screw compressor 1 is equipped with a drive side rotor 2 and a driven side rotor 3, and further connected in succession with an oil separator 6 and oil coolers 7 and 8 through discharge pipes 14 and 17. Further, a suction throttle valve 10 is arranged in a suction pipe 12, and a solenoid valve 11 is arranged at the edge part of an operating pipe 18 branched from the discharge pipe 14. The suction throttle valve 10 is opened and closed according to the revolution speed signal of an inverter 19 and the compressed air in the discharge pipe 14. In this constitution, the pressure detection value of a pressure sensor 21 installed in a discharge pipe 15 and the set pressure value are compared by a PID controller 20. Accordingly, the output revolution speed of the inverter 19 is calculated so that the pressure difference between both becomes min.



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CLAIMS

(57) [Claim(s)]
[Claim 1] In the screw compressor whose load under load operation it has an inverter, and drives with this inverter, and is size compared with the load at the time of starting The pressure sensor which detects the pressure of the compressed air breathed out from said screw compressor, An intake side is closed before starting of a screw compressor with the rotational frequency signal from an inverter. The intake side closing motion means which makes an intake side open when the peak value of the starting torque at the time of a screw compressor being the usual load starting is passed and the rotational frequency of a low starting torque is reached, The inverter drive screw compressor characterized by forming the PID-control equipment which calculates the engine speed outputted to said inverter so that change of the detection pressure force of said pressure sensor over the set point may become min after said screw compressor starts smoothly.
[Claim 2] The aforementioned intake side closing motion means is an inverter drive screw compressor according to claim 1 characterized by having the intake throttle valve installed in the suction pipe linked to a screw compressor's intake side, and this solenoid valve that suck up, and open and close ****** with the engine-speed signal from said inverter.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to the screw compressor driven with an inverter, and relates to a suitable inverter drive screw compressor to supply the compressed air of the pressure which is a constant pressure and is especially demanded from change of a use air content.
[0002]
[Description of the Prior Art] In the screw compressor driven with the conventional inverter, the output of an inverter is controlled by the rate data of a motor, or the load data of a screw compressor, each means for accelerating, a displacement control, and starting is made unnecessary by this, and what simplified the configuration is proposed as indicated by JP,55-164792,A, for example.
[0003]
[Problem(s) to be Solved by the Invention] In a screw compressor, since it has the property which becomes large as the starting torque in the low-speed rotation region at the time of starting shows drawing 3 as a continuous line by the leakage by the side of intake of the compressed air etc., when driving with the low inverter of the generating torque in the low-speed rotation region shown with the chain line, the starting torque of a screw compressor will exceed the generating torque of an inverter. On the other hand, with the above-mentioned conventional technique, consideration about this point was not carried out, but there was a problem that a compressor stopped. Moreover, a use air content changes with the operating conditions of a

user's compressor, and fluctu[redacted] of a pressure occurs in connection with t[redacted] On the other hand, with the above-mentioned conventional technique, consideration about this point was not carried out, but there was a problem of supplying the large compressed air of low quality of pressure fluctuation.
[0004] The 1st purpose of this invention is to offer the inverter drive screw compressor which enables supply of the compressed air of the small high quality of pressure fluctuation, even if it changes a use air content corresponding to the operating condition of a user's pneumatics device.
[0005] The 2nd purpose of this invention has a screw compressor in offering the inverter drive screw compressor whose starting is smoothly enabled with an inverter at the time of starting.
[0006]
[Means for Solving the Problem] In order to attain the above-mentioned purpose, it sets to this invention. The pressure sensor which detects the pressure of the compressed air breathed out from a screw compressor, An intake side is closed before starting of a screw compressor with the rotational frequency signal from an inverter. The intake side closing motion means which makes an intake side open when the peak value of the starting torque at the time of a screw compressor being the usual load starting is passed and the rotational frequency of low driving torque is reached, After said screw compressor started smoothly, the PID-control equipment which calculates the rotational frequency outputted to said inverter was formed so that change of the detection pressure force of said pressure sensor over the set point might become min. [0007]
[0008] Moreover, the aforementioned intake side closing motion means has the intake throttle valve installed in the suction pipe linked to a screw compressor's intake side, and the solenoid valve which open and close this intake throttle valve with the rotational frequency signal from said inverter.
[0009]
[0010]
[0011]
[Function] Since according to said invention a screw compressor is started with the intake side closing motion means controlled by the signal from an inverter where an intake side is closed and it is less than the starting torque of a screw compressor from the starting torque in the case of the usual load starting, and the starting torque at the time of a low load, a screw compressor can be started smoothly. Moreover, since the rotational frequency of a screw compressor rises gradually, an intake side opens with the intake side closing motion means controlled by the signal from said inverter when the peak value at the time of being the usual load starting is passed and the rotational frequency of low torque is reached and a screw compressor performs load operation, a screw compressor can compress air to a predetermined pressure smoothly.
[0012] Moreover, since the intake side closing motion means consists of an intake throttle valve installed in the suction pipe linked to an above-mentioned screw compressor's intake side, and a solenoid valve which makes this intake throttle valve open and close with the signal from the above-mentioned inverter, it can attain the function of an intake side closing motion means with an easy configuration.
[0013]
[0014]
[Example] Hereafter, drawing 1 and drawing 2 R> 2 which show one example of this invention are explained.
[0015] In drawing 1 , 1 was used as the screw compressor, and formed a motor 5, driving-side Rota 2 rotated through coupling 4, and follower side Rota 3 geared and rotated to this driving-side Rota 2, and has connected the discharge side to an oil separator 6 through a discharge tube 13. An oil separator 6 separates the oil contained in the compressed air and this compressed air, and sends delivery and oil for the compressed air to an after-cooler 7 through the oil piping 17 at an oil cooler 8 through the regurgitation piping 14. An after-cooler 7 cools the compressed air and supplies it to a user through the regurgitation piping 15. On the other hand, an oil cooler 8 cools oil and sends it to bearing of a screw compressor 1 etc. through the oil piping 16. 10 is used as an intake throttle valve, connects the end section to a screw compressor's 1 intake side, and is installed in the middle of the intake piping 12 which has an inlet filter 9 in the other end. 11 is used as a solenoid valve, is installed in the edge of the actuation piping 18 which branches from the regurgitation piping 14, and carries out switching operation of the intake throttle valve 10 by the compressed air from the above-mentioned regurgitation piping 14 with the signal from an inverter 19. As 19 is used as an inverter and a continuous line shows to drawing 3 , beforehand It asks for the relation between the load starting torque of the usual screw compressor 1, and a rotational frequency. Before starting of the above-mentioned screw compressor 1, the signal which closes the above-mentioned intake throttle valve 10 is outputted to the above-mentioned solenoid valve 11. Then, rotational frequency N1 of the peak

value which starts the above-mentioned screw compressor 1 and is shown in drawing 3 as a continuous line Rotational frequency N2 of a low starting torque When it reaches, an opening-above-mentioned intake throttle valve 10 signal is outputted to the above-mentioned solenoid valve 11. In addition, it is asking for the rotational frequency of the above-mentioned screw compressor 1 from the peripheral velocity of Rota 2 and 3 etc. The current or voltage signal output equivalent to the detection pressure force value A of the compressed air detected by the pressure sensor 21 installed in the above-mentioned regurgitation piping 15 as 20 was used as PID-control equipment and it was shown in drawing 2 , The current or voltage signal equivalent to the setting pressure B set up beforehand is compared, and the output engine speed to the above-mentioned inverter 19 for change of both differential pressure to become min is calculated, it outputs to an inverter 19, and the above-mentioned motor 5 is rotated. In addition, the above-mentioned setting-pressure value B is made to be changed by turning a tongue (not shown), corresponding to the operating condition of the compressed air.

[0016] Actuation is explained below. It changes into the condition of having shut the intake throttle valve 10 completely through the solenoid valve 11 before starting of a screw compressor 1 from the inverter 19. If a motor 5 is rotated in this condition, driving-side Rota 2 and follower side Rota 3 rotate through coupling 4, like a vacuum pump, an intake side will serve as a vacuum, a discharge side will serve as a pressure more than the pressure in an oil separator 6, and a screw compressor 1 will carry out the regurgitation of the compressed air. Therefore, the starting torque of a screw compressor 1 becomes smaller than the starting torque shown with the chain line of the starting torque and inverter 19 which are shown as the continuous line at the time of opening the intake throttle valve 10 to drawing 3 , and performing the usual load operation to it as an alternate long and short dash line shows. rotational frequency N2 which the rotational frequency for which it asked from the frequency of Rota 2 and 3 etc. the appropriate back shows to drawing 3 That is Rotational frequency N1 of the peak value at the time of the usual starting operation shown in drawing 3 as a continuous line Rotational frequency N2 of the starting torque which fully fell When it reaches, The intake throttle valve 10 opens through a solenoid valve 11 with the output signal from an inverter 19, the open air is inhaled to an intake side through an inlet filter 9 and the intake piping 12, and load operation is performed. Therefore, a screw compressor 1 can be started smoothly. The air compressed with the screw compressor 1 is sent to an oil separator 6 through a discharge tube 13, separates the oil contained in the compressed air and this compressed air by the oil separator 6, and in oil, after it cools oil by delivery and the oil cooler 8 to an oil cooler 8 through the oil piping 17, it refuels bearing in a screw compressor 1 etc. through the oil piping 16. On the other hand, after the compressed air cools the delivery compressed air to an after-cooler 7 through the regurgitation piping 14, it is supplied to a user through the regurgitation piping 15. Moreover, a part of compressed air from an oil separator 6 branches from the regurgitation piping 14, it is sent to a solenoid valve 11 through the actuation piping 18, and is used as switching operation air of the intake throttle valve 10.

[0017] If a user's use air content increases more than the amount sent to a user from the regurgitation piping 15, the pressure of the compressed air sent to a user from the regurgitation piping 15 will decline gradually from the setting-pressure value B. The pressure sensor 21 installed in the regurgitation piping 15 detects this, and a detecting signal is always outputted to PID-control equipment 20. With PID-control equipment 20, as shown in drawing 2 , the signal of the detection value A from a pressure sensor 21 is compared with the signal of the set point B, an inverter 19 output engine speed from which the detection pressure force value A by the pressure sensor 21 becomes min about change of the detection pressure force value A over the setting-pressure value B when smaller than the setting-pressure value B is calculated, and the output engine-speed signal based on the result of an operation is sent to an inverter 19. In an inverter 19, it goes up to the rotational frequency based on the output rotational frequency signal from PID-control equipment 20, and the rotational frequency of a motor 5 is raised. Therefore, the compressed air which the discharge quantity of the compressed air of a screw compressor 1 increases, and is sent to a user from the regurgitation piping 15 serves as an amount corresponding to a user's use air content, and the detection pressure force value A by the pressure sensor 21 is held at the setting-pressure value B. Moreover, if a user's use air content decreases rather than the amount sent to a user from the regurgitation piping 15, it will go up gradually from the pressure set point B of the compressed air sent to a user from the regurgitation piping 15. A pressure sensor 21 detects this and a detecting signal is outputted to PID-control equipment 20. With PID-control equipment 20, the output engine speed to an inverter 19 is calculated so that the variation of the detection pressure force value A from a pressure sensor 21 to the setting-pressure value B may become min, and the output rotation signal based on the result of an operation is sent to an inverter 19. In an inverter 19, it lowers

to the rotational frequency ba[redacted]on the output rotational frequency from P[redacted]control equipment 20, and the rotational frequency of a motor 5 is reduced. Therefore, since the discharge quantity of the compressed air of a screw compressor 1 decreases, the pressure of the compressed air sent to a user from the regurgitation piping 15 is held at the setting-pressure value B. In addition, since the above-mentioned setting-pressure value B can be changed according to a demand of a user in the possible pressure range of a screw compressor 1, if the compressed air of high quality can be supplied with sufficient user-friendliness and the need minimum pressure is also set up, since a useless pressure is not consumed, there is the great energy-saving effectiveness. Moreover, it is also possible to constitute the above-mentioned PID-control equipment 20 and the above-mentioned inverter 19 in one body, as shown in drawing 4 .

[0018]

[Effect of the Invention] Since this invention is constituted as explained above, the effectiveness indicated below is done so.

[0019]

[0020] Since it is controllable not to exceed the starting torque in the case of the usual load starting of the starting torque of a screw compressor, and the starting torque at the time of a low load by controlling an intake side by the rotational frequency signal of an inverter according to this invention, a screw compressor can be started smoothly.

[0021] Moreover, even if the use air content of the compressed air by the side of a load changes, the compressed air of the high quality of a constant pressure can always be supplied with sufficient user-friendliness.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] Drawing showing the 1 operation Fig. of this invention.

[Drawing 2] The flow chart which shows the PID-control equipment of this invention.

[Drawing 3] Drawing showing the starting torque of a screw compressor.

[Drawing 4] The perspective view showing the case where PID-control equipment and an inverter are made into one body.

[Description of Notations]

1 [-- Coupling, 5 / -- A motor, 6 / -- An oil separator, 7 / -- An after-cooler, 8 / -- An oil cooler, 9 / -- An inlet filter, 10 / -- An intake throttle valve, 11 / -- A solenoid valve, 19 / -- An inverter, 20 / -- PID-control equipment, 21 / -- Pressure sensor.] -- A screw compressor, 2 -- Driving-side Rota, 3 -- Follower side Rota, 4

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